

REPORT UPON A COLLECTION OF NUDIBRANCHIATA FROM THE
CAPE VERD ISLANDS, WITH NOTES BY C. CROSSLAND.

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PLATE XIV.

THE collection of Nudibranchs which forms the subject of the present paper was made by Mr. Crossland in the Cape Verd Islands (St. Vincent, St. Jago, and Boa Vista) during the Summer of 1904. His notes on the living animals are in most cases reproduced verbatim, but have not had the advantage of his revision, as he is absent in the Sudan, and he is not responsible for the anatomical notes, nomenclature, or views contained in the following pages.

The new forms discovered by Mr. Crossland are neither very striking nor very certain, and the interest of the collection lies mainly in the light which it throws on the distribution of this group of Mollusca, and on the differences between the fauna of the tropical Atlantic and the tropical Pacific. A list of the species, as far as they can be determined, is given below, but the identification has often been a matter of difficulty, as nearly all the specimens are small and inconspicuous. This may mean that they are immature. If the animals spawn in the Spring, half-grown individuals would be frequent at the time that Mr. Crossland collected. On the other hand, an examination of the Nudibranchs collected by myself in Samoa, and by Mr. Stanley Gardiner in the Maldive and Laccadive Islands, suggests that specimens from small islands, which have never been connected with the mainland, are not as large as those found on the shores of the mainland and its adjacent islands.

LIST OF SPECIES.

NAME.	PREVIOUSLY RECORDED FROM.
1. <i>Tritonia moesta</i> , Bergh, var. <i>pallescens</i> , n.var.	Mediterranean.
2. <i>Staurodoris atypica</i> , n.sp.	Allied species from Mediterranean and West Atlantic.
3. <i>Discodoris indecora</i> , Bergh	Trieste.
4. <i>Discodoris muta</i> , Bergh	Guadaloupe.
5. <i>Discodoris</i> sp.	
6. <i>Geitodoris reticulata</i> , n.sp.	Allied species from Plymouth.
7. <i>Peltodoris</i> sp.	
8. <i>Rostunga Evansi</i> , n.sp.	
9. <i>Cadlina Clarae</i> , von Ihering	Naples.
10. <i>Chromodoris gracilis</i> (Delle Chiaje)	Mediterranean.
11. <i>Doridopsis grandiflora</i> , juv. (Rapp)	Mediterranean.
12. <i>Doriopsisilla Pelseneeri</i> (?), <i>D. areolata</i> (?)	South Portugal, west coast of Africa, Mediterranean.
13. <i>Plocamopherus Maderæ</i> (Lowe)	Madeira.
14. <i>Doto obscura</i> , n.sp.	
15. <i>Doto cinerea</i> , Trinchese	Mediterranean.
16. <i>Spurilla neapolitana</i> (Delle Chiaje)	Mediterranean.
17. <i>Amphorina pallida</i> , n.sp.	
18. <i>Phidiana longicirrhæ</i> , n.sp.	
19. <i>Facelina Drummondi</i> (Thompson)	British and Scandinavian waters.
20. <i>Favorinus carneus</i> ? (A. & H.)	South England.
21. <i>Favorinus</i> sp.	

Mr. Crossland, in a paper on the Ecology and Deposits of the Cape Verd Marine Fauna (Proc. Zool. Soc. London, 1905, vol. i, pp. 170-186), points out that the islands lie in the path of the southern division of the Gulf Stream, which is joined by another current from near the Straits of Gibraltar. Both of these are cold currents, the warm stream from the Gulf of Guinea passing a little to the south of the islands. The above list is quite in keeping with this system of currents, for there is a marked absence of characteristic tropical forms, whereas the Mediterranean element is large, and species recorded from the West Indies and tropical Atlantic are represented. Probably this western element is really larger than it appears to be, for our knowledge of West Indian Nudibranchs is very imperfect, and hardly twenty have been identified with certainty. It is also probable that many of the Mediterranean forms are not specially Mediterranean, but also found in the Azores, Canaries, Madeira, etc.

The lists of molluscs given by Rochebrune ("Matériaux pour la Faune de l'Archipel du Cap Vert," in Nouvelles Archives du Muséum d'Hist. Nat. Paris, 1881, ser. II, tome iv) yield much the same result. Of 201 molluscs, 21 are recorded only from the islands, 5 from the coast of America, 16 from European seas, and 70 from the Mediterranean; while of 285 marine invertebrates of all kinds, 48 are recorded only from the islands, 23 from the west coast of America, and 91 from the Mediterranean. Rochebrune mentions only one Nudibranch, *Peltodoris Sawagei*, which is perhaps a colour variety of *P. crucis*.

Regarded as tropical Nudibranchs, the present collection offers a remarkable contrast with the forms found in the corresponding latitudes of the Indo-Pacific. There are no specimens of *Platydoris*, *Bornella*, *Kentrodoris*, *Hexabranhus*, *Phyllidia*, *Trevelyana*, or *Asteronotus*, and the Chromodorididæ are represented by only one small species. The first two of the above-mentioned genera are recorded from the West Indies, but the rest have not been found in the Atlantic, though the "Talisman" obtained a *Phyllidiopsis* in the Bay of Biscay. Mr. Crossland (l.c.) also notices the absence of large and highly coloured Planarians, which are very abundant in the Indo-Pacific. In many parts of that ocean, for instance, Zanzibar and the east coast of Africa, the coast in sheltered parts consists of flat, table-like coral reefs, which house an incredible amount of marine life. Alcyonarians are abundant, and sometimes form a living carpet. In the Cape Verd Islands the conditions are widely different: Alcyonarians and corals are rare, and the organic rocks are formed chiefly of Nullipores and *Vermetus* between tides, and below tide-marks of *Lithothamnion* and great quantities of a Foraminiferan.

As we have no information about the Nudibranchs of the West African coast between the Cape Verd Islands and the Cape of Good Hope, it would be rash to assume that the present collection is typical of the fauna of the Equatorial Atlantic. It may be that on reaching the warm current from the Gulf of Guinea, passing to the south of the Cape Verd Archipelago, we should find other forms. But what

does seem to be clear is, that in the Atlantic there is for Nudibranchs (and probably for many other groups) a faunistic district which extends from the level of the Mediterranean at least as far south as 15° N., whereas in the Indo-Pacific the equatorial fauna extends as far north as Suez and Karachi. The southward limit of the Atlantic sub-tropical fauna is unknown. To the north it gradually passes into the northern fauna, the boundary being somewhere about the British Isles. A good many species are common to both faunas, but the north is characterized by such Dorids as *Acanthodoris*, *Lamellidoris*, *Adalaria*, etc., and by an abundance of such Æoliids as *Æolidia*, *Galvina*, *Coryphella*, and *Cratena*. It is perhaps a mere matter of chance that the last genus is not recorded from the Mediterranean, but clearly these forms are more abundant towards the north. *Gonicolis*, *Chlamylla*, and *Doridunculus* appear to be exclusively northern.

It is noticeable that several of the forms from the Cape Verd Islands, here described as new, are closely allied to known species (e.g. *Staurodoris atypica*, *Geitodoris reticulata*), and many of those referred to known species present well-marked variations (e.g. *Tritonia mæsta*, *Doto cinerea*, and *Spurilla neapolitana*). Taken together, these facts suggest that forms found in the Mediterranean and the parts of the Atlantic in about the same latitude become differentiated further south.

As isolated facts of interest may be noticed the habit ascribed to *Doriopsisilla* (? *areolata*) of sunning itself in tide-pools; the absence of a penial armature in the young *Doridopsis grandiflora*, suggesting that this feature is developed with age; and the development of the teeth, as shown in the young *Cadlina Claræ*.

TRITONIA MÆSTA, Bergh, var. PALESCENS, n.var. Pl. XIV, Fig. 1.

Tritonia mæsta, Bergh: Semper's Reisen im Arch. Philip., pt. xv, pp. 734-736 (1884); Vayssière, Ann. Mus. Marseille, vol. vi, pp. 100-1 (1901).

Mr. Crossland's notes on the living animal are as follows:—

"Small and opaque white, with pink organs dimly showing through. Between the bases of the rhinophores some have a broad crescent of dark crimson lake.

"Of the usual high square-cut shape, but the back slopes gently down to the tail: this is long and tapering, colourless and transparent. The long rhinophore-cups have a light brown tinge. A few specks of dark red occur on the back in some specimens, but several are merely white all over. Velum with 2 long anterior processes, and 2 shorter lateral. Rhinophores long, with a central pillar surrounded by a cluster of delicate tentacle-like processes. Gills, 3 pairs. The first pair largest, with 2 main branches: the rest have simple branches with short papilla like side branchlets. The foot adheres very strongly, and is damaged in several specimens. It is quite colourless and transparent. In some specimens the expanded lateral margin of the foot is seen when the animal is crawling, but sometimes not at all. The anterior processes of the velum may be carried vertically at times.

Found under a stone whose lower surface was covered with a red Alcyonarian, some Polyzoa and *Tubularia*. They seemed to haunt the Polyzoan principally. Found in the same habitat on two occasions."

The preserved specimens are much contracted, the largest being only 3.5 mm. long, and the external characters described by Mr. Crossland can be verified only with difficulty. The four digitations on the frontal veil still remain in the form of knobs, but in some specimens the outer pair are distinctly grooved, showing that they represent tentacles. The foot is rounded in front. The branchiæ are reduced to mere lumps: the plumes have perhaps been rubbed off.

In the specimen dissected the formula of the radula is $21 \times 11.1.1.1.11$. The teeth are as represented by Bergh (l.c., pl. lxxiv, fig. 21). The median tooth is distinctly tricuspid; the first lateral less clumsily shaped than usual in the genus, and distinctly hamate, the hook bending over the side and top of the median tooth. The jaws are as in Bergh's pl. lxxvi, fig. 3, but bear at least eight rows of denticles on the edge. There are no stomach plates.

These specimens are remarkable externally for having only four processes (including the tentacles) on the oral veil, a character which is shared by *T. lineata* and *T. mæsta*, but they approach more nearly to the typical *T. mæsta* because they have a narrow radula and no lines on the dorsal surface. The coloration also approaches that of *T. mæsta*. According to Vayssière (l.c., pl. i, fig. 19), the animal is not so much black as yellowish, with a good deal of black down the centre of the back. In the present variety this dark pigment is reduced to a band between the rhinophores and some spots on the dorsal surface.

T. mæsta is possibly the same as the *Duraucelia gracilis* of Risso (Hist. nat. Europe Mérid., vol. iv, pp. 38-9, 1826).

STAURODORIS ATYPICA, n.sp. Pl. XIV, Fig. 2.

Mr. Crossland's notes on the living animals are as follows:—

"Under stones at Porto Praya, lee of Quail Island. Bright light yellow, gills same tint, but perfoliations of rhinophores a little deeper. The rhinophores stand vertically, and only the perfoliated part is shown. Back covered with small warts evenly distributed. Mantle fairly broad, nearly colourless and translucent. Rhinophores and gill pockets not raised. Gills simply pinnate, and peculiarly long and slender (see the coloured sketch), ten¹ in number, very sensitive. Under side shows head and foot (latter broad) of a deep yellow, especially head and anterior edge of foot which is grooved, though there seems to be no notch in the anterior lip of the groove. Back rather broad and rough, showing spicules. Shape flat, but not conspicuously stiff.

"A smaller specimen from St. Vincent: in this only the head of all the under surface is of a deeper yellow."

¹ Twelve in sketch, but ten here and in nature.—C. E.

The larger specimen is very flat and much bent. It is about 15 mm. long, 7 mm. broad, and 4 mm. high. The dorsal surface is covered with warts of various sizes, bearing smaller prominences. The integuments are full of spicules, which are fairly straight rods, not branched, but jointed. The pockets of the rhinophores and branchiæ do not project, and their margins bear tubercles which are similar to those which cover the rest of the dorsal surface, and are not specially developed to act as lobes or defences. The branchiæ are ten in number, long and simply pinnate. The foot is large, nearly as long as the body, and 6 mm. broad. It is grooved in front, but not notched. The tentacles are much as in *Archidoris tuberculata*.

No labial armature was found. The radula consists of 38 rows, with a formula of about 30 . 0 . 30. The teeth are hamate, rather straight and stout, with long bases. The innermost and outermost are not so large as those in the middle of the half-row, and the two or three outermost are quite small.

No armature was discovered in the genitalia.

The common *S. verrucosa* shows great variation in the size and number of the dorsal tubercles, and these specimens might be regarded as a variety in which the usual protective valves of the rhinophores and branchiæ have not been developed. I hesitate, however, to take this view without further evidence, because the dorsal tubercles in the present specimens are not smooth and clavate, but low, rough warts bearing secondary projections. The radula also is narrower than is usual in *S. verrucosa*.

DISCODORIS, Bergh.

This genus consists of rather large animals of a flat shape, with a granulated or minutely tuberculate dorsal surface, and usually a wide mantle margin completely covering a moderately broad foot. A labial armature is present. The radula has no central tooth, but bears a considerable number of simply hamate laterals. There is no armature in the genitalia, but a prostate is present.

Platydoris somewhat resembles *Discodoris* in general appearance, but has a peculiar hard consistency, a characteristic armature in the genitalia, and no labial armature.

Bergh, in his *System der Nudibranchiaten Gasteropoden*, enumerates eighteen species, to which the following have since been added: (19) *D. Edwardsi*, Vayssière; (20) *tristis*, Bergh; (21) *erubescens*, Bergh; (22) *maculosa*, Bergh; (23) *dubia*, Bergh; (24) *egena*, Bergh; (25) *Heathi*, MacFarland; (26) *labifera*, (Abraham); (27) *D. (?) Sibogæ*, Bergh; (28) *D. (?) liturata*, Bergh; (29) *D. (?) lutescens*, Bergh; (30) *D. (?) versicolor*, Bergh; (31) *D. (?) rubra*, Bergh. The last five forms are regarded by Professor Bergh as only doubtfully referable to *Discodoris*, and it must be admitted that many of the species described agree only incompletely with his original definition of the genus.

Most of the species are recorded from the Indo-Pacific, but *D. notha* and *muta* are from the West Indies, *D. Edwardsi* from the west coast of Morocco, *D. tristis* from the Azores, *D. erubescens* from Naples,

D. egena from Trieste, *D. Heathi* from California, and *D. dubia* and *D. egena* from Tasmania. The genus is thus fairly widely distributed, but seems to shun the northern Atlantic and the coasts of South America. The allied *Geitodoris*, however, occurs in the former region, and the Nudibranchs of the latter have been little investigated. It is clear, however, that the genus is most abundant in the warmer seas.

Many of the species recorded from the Atlantic have a harder consistency than the more typical forms from the Indo-Pacific, and this is certainly the case with the specimens noticed below.

Bergh originally classified the *Doris Elliotti* of Alder & Hancock (Notice of a collection of Nudibranchiate Molluscs made in India) as *Platydoris*, but in his recently published account of the Nudibranchs found by the Siboga he identifies it with a *Discodoris* in that collection. I have, however, examined the type-specimen preserved in the Hancock Museum at Newcastle-on-Tyne, and ascertained that the earlier classification under *Platydoris* is correct. The animal has no lip plates, but a very strong armature of hook-bearing scales on the genitalia. The Siboga specimens should perhaps be called *Discodoris Berghi*, n.sp.

DISCODORIS INDECORA, Bergh.

Discodoris indecora, Bergh: Semper's Reisen, Supp., Heft ii, 1881, pp. 108-112.

Mr. Crossland's notes on the two living specimens are as follows:—

"Dorid, blue grey. Found among Nullipore nodules 5-10 fathoms in Porto Grande, St. Vincent, and also under a stone in Porto Praya, Santiago. About 18 mm. long by 10 mm. wide, white below, of a cool grey above with a bluish bloom. Quite smooth, no papillæ, but harsh to the touch, very sluggish. Colour is modified by the presence of minute black specks thickly sown over the dorsal surface. At a point where the mantle joins the body dorsally is an irregular line of irregular white blotches made up of opaque white specks, larger than the black ones.

"Rhinophores and gills both completely retractile. Both tipped with white. The latter have an extraordinarily thick rhachis, and the branched parts are extremely small, but it is possible that they were not seen fully expanded. They appear to be bipinnate. The specimen from Porto Praya has no bluish tint, and is of a cool grey colour. Gills as described, even when fully expanded, 4 in number, bipinnate and not so very small. This specimen is warty, and the other markings, etc., are as above."

The preserved specimen from Porto Praya is of a cool grey colour, and hard and stiff in texture. It is much bent, but, if straightened out, would be about 30 mm. long and 15 mm. broad. It is very flat, the maximum height being only 5 mm. On the outer parts of the dorsal surface are scattered tubercles, extending 5-8 mm. inwards from the margin. They are of various sizes, the largest being about a millimetre broad and half a millimetre high. The middle of the back appears smooth, but under the lens shows indications of obscure flat tubercles. The spaces between the tubercles are finely granulated.

The rhinophore openings are on small hillocks, but there are no projecting sheaths. The branchial pocket is nearly closed, and not at all raised. It was possibly stellate when open. There are four branchiæ and an asymmetrical small plume. The rhachis is stout; the ramifications scanty, and mostly only bipinnate. The foot is considerably shorter than the body, with a wide margin. It is much bent and contracted, but measures about 15 by 7 mm. It is apparently grooved and notched in front. The tentacles are digitate, with a slight groove on the outside.

The internal organs are mostly white. The labial armature consists of two hatchet-shaped plates, which might also be possibly regarded as representing a circle with two processes extending backwards. The constituent elements are minute rods of rather irregular shape, often swollen at the ends. The radula is narrow and of rather unusual appearance. There are 51 rows, containing not more than 16 or 17 teeth on each side of the bare rhachis. The teeth are rather straight and broad, and those in the middle of the half-rows are almost spoon-shaped and hardly hamate in appearance. The innermost and outermost teeth are smaller. The bases are long, especially those of the innermost teeth. Such stomach as there is appears to be wholly outside the liver, but it is very small and merely a dilatation of the general digestive tract. Both it and the intestine are thickly laminated inside. The liver is greyish, not very compact, and with many lacunæ. It is clothed with the dead-white follicles of the hermaphrodite gland. The connecting tubes between the follicles are more distinct than usual.

The renal organ is very distinct and exhibits beautifully dendritic ramifications. The blood-gland is double and much lobed, especially the anterior portion. The central nervous system is granulate and enclosed in a strong capsule. The ganglia could not be clearly separated.

The genitalia appear to be as usual in the genus. A spermatheca, spermatocyst, and prostate were found, but no armature. There is perhaps an accessory folliculate gland in the vestibule.

The second specimen is externally as described by Mr. Crossland. The white blotches are somewhat raised and almost tubercular. The branchiæ are four, but one is bifid. The tentacles have a slight but distinct groove on the outer side.

These specimens may be referred with some certainty to Bergh's *Discodoris indecora*, recorded from Trieste, with which they agree not only in general characters, but in such details as the narrow radula and grooved tentacles.

DISCODORIS MUTA, Bergh.

Discodoris muta, Bergh: Semper's Reisen, Heft xii, 1877, pp. 532-4.

One specimen. The notes on the living animal are as follows:—

“Dorid, large grey. Under a stone (Gastropod shell mass), Boa Vista.

“Leathery but not harsh to the touch. Foot broad, mantle moderately so, of wavy outline and rather mobile.

“Gills of moderate size, tripinnate. Rhinophores stand vertically. Both pockets close completely, edges a little raised when open. The

lateral branches of the gills stand vertically, so that the gills form a cabbage-shaped tuft, rather than a flat rosette. Autotomy of mantle-edge during apparently healthy life. Colour light grey with darker spots which are small and irregularly scattered, gills and the rhinophores coloured like the body, perfoliations of rhinophores rather darker. Under side uniformly white. Foot grooved and notched. Tentacles small but pointed."

The preserved specimen is 47.5 mm. long and 19 high. The breadth is about 30, but the edges of the mantle have been thrown off. It would appear that this margin was ample when it was complete, and measured about 15 mm. The colour is pearly grey, mottled in places, but not everywhere, with rather darker greyish spots, which are sometimes confluent. The back is minutely granulate, and in most places feels quite smooth, but here and there the granulations are covered with a hard, white deposit, and in these patches (the largest of which measures about 5×3 mm.) the skin feels harsh and rough. The general consistency is waxy.

The foot is grooved and notched in front. The tentacles are rather small, but distinct and pointed. The left is bifid, which is no doubt a monstrosity. The gill and rhinophore-pockets are completely closed, and invisible from the outside. There is no trace of a raised rim or tubercles, but the inside of the gill-pocket looks as if it might have been stellate when open. The rhinophores are stout and yellow. The branchiæ consist of six main plumes, but one is deeply divided, so that they might be counted as seven. They have a faint green tinge and are tri- or quadripinnate, stout, but not ample, with broad stems and somewhat scanty ramifications.

The integuments are thick, and contain a dense mass of rod-like spicules which have a tendency to arrange themselves in a reticulate pattern. On removing them is seen the liver, covered by the yellowish hermaphrodite gland, contrasting markedly with the other organs (buccal mass, œsophagus, stomach, etc.), which are waxy white. The strong labial cuticle bears an armature of two very distinct, triangular, brown plates, composed of a dense collection of longish rods which can be seen separately only at the edges. The radula consists of 30 rows of teeth, of which 20 seem to be in use. The rows contain at most 40-45 teeth on each side of the rhachis, but many are much shorter. The teeth near the rhachis are smaller than the others, and very irregularly arranged, being apparently easily displaced. Those in the middle of the half-row are largest: the outer 8 or 10 begin to decrease, and the two or three outermost are markedly smaller, but not rudimentary. There are two yellowish salivary glands, about 5 mm. long and 2.5 broad. The long, thin ducts measure about 12 mm. The œsophagus, 13 mm. long, runs straight to the stomach and enters its under side. The stomach (12 mm. long, 6.5 mm. broad) has moderately strong walls and lies on the front part of the liver, completely outside it. The intestine is long. The œsophagus, intestine, and stomach are all laminated internally. The liver is large, and, as preserved, is drawn up into a sort of globular dome at the back. It shows signs of a division into several lobes, and is very loose in texture, with

many lacunæ. It is covered with a remarkably thick layer of the hermaphrodite gland, which is everywhere at least 1 mm. deep, and in some places as much as 3 mm.

There are two distinct blood-glands, one before and one behind the central nervous system. They are irregularly lobed, but not much indented, and olive green, contrasting markedly with the white organs around them. The central nervous system is yellowish, and enclosed in a strong, white capsule. The ganglia seem to be close to one another, and I was not successful in separating them. Their surface is granulated. The yellowish lens of the eyes is very large, the black part small.

A prostate is present, but no armature of the reproductive organs was found. The spermatheca is very large, and coloured brown by its contents.

This form seems to agree in its principal external and internal features with *Discodoris muta*, Bergh, recorded from Guadaloupe.

Discodoris fragilis (A. & H.) is another species which has been observed to mutilate itself and throw off portions of the mantle-margin while alive.

DISCODORIS sp. Pl. XIV, Fig. 3.

Mr. Crossland's notes on the living animals are as follows:—

"In a crevice of rock, at low tide level, among surf. Porto Praya. Very flat, stiff, and harsh, but back not in any way warty, papillate, or pitted. To naked eye appears of a uniform orange brown, darker on the visceral mass, lighter round the mantle-edge. Opaque white marks, irregularly scattered round mantle-edge, and larger ones near the middle of the body where mantle joins the visceral mass. Rhinophores of a darker shade, points directed backwards. Gills 6, tri-pinnate, rather small. Gill-pocket with 6 large teeth, but cannot close completely. Rhinophore-pockets also raised, with large and small teeth irregularly placed. Gills sandy and dark brown, former colour predominating. Under lens, colour seen to be due to a dark-brown network with very small round yellow meshes.

"Under side shows ample mantle with wavy outline. Foot grooved and notched. Oral tentacles fairly long. All bright yellow, except for small deep brown spots on the inner part of the mantle."

The larger specimen accords with this description, but the orange brown has become grey. There are some reddish spots on the under side near the junction of the mantle and the body. The shape is very flat. The length 34 mm., the breadth 21.5 mm., and the height 5.5. The mantle-edge overhangs the body all round, and in some places is 8 mm. wide. The back is finely granulate; the integuments stiff, waxy, and brittle.

The smaller specimen is similar, but has preserved more of the orange colour, and is only half the size.

The foot is much shorter than the body, being only 18 mm. long in the larger specimen. It is ample in front, but in neither specimen is it clear that there is a groove. The tentacles are rather large and digitate. The branchiæ are 6, besides a small detached plume. The

integuments are full of short, rod-like spicules. On opening the body-cavity, the intestines were found to be much hardened and badly preserved in both specimens.

There is a labial armature of two small brownish plates. They are rather faint and not at all strong. They are composed of scale-like elements, and resemble the mosaic found on the masticating edge of *Tritonia* rather than the labial plates usual in *Discodoris* (Fig 3).

The radula consists of 46 rows, each containing from 65 to 70 teeth on either side of the narrow, bare rhachis. The innermost teeth are smaller, and often cross one another over the rhachis, so as to give a false impression of median teeth. The outermost teeth are degraded and plate-like, but not serrulate. The rest are hamate, moderately bent, and moderately tall. There are a few bifid teeth, but they appear to be merely monstrosities.

The blood-gland is white. The central nervous system is not well preserved, but appears concentrated.

The state of preservation renders it impossible to make any certain statements about the digestive and reproductive organs. There appeared to be a distinct stomach, external to the liver, but I could not find the usual layer of the hermaphrodite gland spread over the liver. The male branch of the reproductive system terminates in a pouch containing the much convoluted vas deferens. In both specimens the efferent genital ducts seemed to bear colourless scales or prominences, so thin and transparent as to be almost invisible.

In the uncertainty as to many of the internal organs, I do not think it worth while to create a new species for these specimens. They are not certainly identifiable with any described form, but may possibly represent a variety of one of the Mediterranean *Discodorids* or *Paradoris*.

GEITODORIS, Bergh.¹

This genus resembles *Rostanga* in many points, on the one hand, and, on the other, comes very near to some of the *Archidorids*, such as *A. testudinaria*, which I identify with the *A. stellifera* of Vayssi re and von Ihering. In this form the teeth grow longer and thinner towards the end of the row, though not so sharply differentiated as in *Geitodoris*, and, according to Vayssi re, a labial armature is present.

The *Doris planata* of Alder & Hancock probably belongs to this genus (v. Eliot, l.c.), and is possibly not really distinct from the type species *G. complanata* (Verrill) from the coast of New England. Two other species have been described by Bergh, *G. immunda* from Panama and *G. mollina* from the West Indies. The latter does not entirely conform to the type of the genus.

GEITODORIS RETICULATA, n.sp. Pl. XIV, Figs. 4, 5a, 5b.

Mr. Crossland's notes on the living animals are as follows:—

“August 16. At St. Vincent. Found under a stone in company

¹ Vide Eliot, Journ. Mar. Biol. Assoc., vol. vii (1906), on *Archidoris testudinaria* and *Geitodoris planata*.

with red sponge and red Alcyonarian. 8 bipinnate gills, some showing tendency to become tripinnate.

"August 17. 5 specimens under a lighter, in company with red sponge of same tint as the Dorid.

"Brilliant vermilion, about $1\frac{1}{2}$ " by $\frac{3}{4}$ ". Colour, at first sight, appears uniform, but under a lens (mag. 10) are seen numerous specks of black pigment, most numerous on the visceral mass, less so on the mantle. The skin is pitted sparsely on mantle, but on the body the pits are very numerous, so that this part appears to be covered with a raised vermilion network, blunt papillæ being situated at the larger junctions. In some specimens these are more numerous and better developed than in others. The pigment-specks are much more numerous in the pits, so that they are a dark grey, throwing up the red network surrounding them. The ends of the rhinophores and the anterior gills are pigmented with black and sandy colour. The lower or posterior gills are the same colour as the body. Small specks of sandy colour occur sometimes also on the body, but are conspicuous only in one specimen. Gills comparatively small, apparently bipinnate, but of so close texture that this is not easily made out. Completely contractile, but pocket does not close. Edge of pocket slightly raised and slightly undulating, sometimes with a thin line of sandy pigment round the edge. Rhinophore-pockets ditto. Rhinophores long and deeply perfoliated.

"The creatures are very soft indeed; the mantle is ample, with a wavy margin. Foot is fairly broad, grooved and notched in front. Tentacles long, slender and mobile. Under surface uniformly vermilion."

Mr. Crossland added the following notes on an orange-brown specimen, which he rightly regarded as a variety of this species:—

"Most probably only a variety of last species. Rather flat, mantle ample, harsh to touch but not particularly stiff. Ground colour a dull light yellow, plentifully besprinkled, especially on the visceral mass, with small blotches made of minute specks of orange-brown. Also dark grey ill-defined dots. Network with pits in meshes over visceral mass, very distinct. Rhinophores large, gills small. Rhinophores perfoliate, all over dark brown and white. The two anterior gills are of the same colour; the six posterior orange. They are simply pinnate and quite symmetrically arranged. Edges of rhinophore and gill-pockets slightly raised, darker brown; gill-pocket with a thin white edging."

The buccal parts and other internal characters are as in the other specimens. The gills, though straight and scanty, can be seen under the microscope to be bipinnate in places.

The ten specimens preserved differ somewhat in appearance, some being white and some reddish brown, but agree in anatomical and essential external features. The white specimens are the larger.

The animals are much bent, but, if straightened out, the largest would be about 50 mm. long and 35 mm. broad. They are very flat, the maximum height being only 8–9 mm. The ample mantle-margin (9–10 mm. wide) overhangs the foot on all sides. The foot is not narrow (about 15 mm. wide), and has expanded margins. The dorsal

integuments are thin; the mantle-edge thickens. The texture and external characters are as described by Mr. Crossland. The pits and ramifying lines are still visible, but not conspicuous (Fig. 4). The openings of the rhinophores and branchiæ are not stellate or markedly tuberculate. The branchial pocket is shallow, and the lateral branchiæ can be counted as either six or eight, the third and fourth plumes on either side being united at the base (Fig. 4). There is generally a small unpaired plume in front, opposite the anal papilla, which completes the circle behind, so that the whole number of plumes seen protruding from the pocket is nine.

The labial armature consists of two greenish plates, composed of short, slightly curved rods, with rather swollen tips. These tips form a mosaic.

The radula is fragile and easily becomes confused. There are about 25 rows, with a formula reaching at least $10 + 35 \cdot 0 \cdot 35 + 10$. At the outer ends of each row is a bunch of long, thin teeth (Fig. 5*b*) lying very close to one another, so that they are difficult to count. There are, however, at least 10 in the bunch or sheaf, and perhaps considerably more. The other teeth (Fig. 5*a*) are comparatively low, hamate, with long bases. The rhachis is narrow, and the innermost laterals of the two sides almost cross one another.

The intestines are whitish. The œsophagus is moderately long, but varies somewhat in different specimens. In all cases, however, it enters the liver without any external dilatation, and the stomach is wholly within the liver.

The hermaphrodite gland is ample, forming a thick, white layer over the liver. There is a large mucous gland, gelatinous, colourless, and semi-solid externally, hard and yellow in the inside. The spermatheca is large and roughly spherical; the spermatocyst small and elongate. No armature of the glans penis was discovered and no prostate.

This species is very nearly allied to the *Geitodoris* found at Plymouth (v. Eliot, l.c.), which is probably identical with the animal called *Doris planata* by Alder & Hancock. It is not improbable that the African and British forms are merely varieties of one species, the tropical specimens being, as is natural, larger and more brightly coloured. But I have thought it safer to describe them under a separate specific name.

PELTODORIS, Bergh.

This genus differs from *Discodoris* only in not having a labial armature, and would perhaps be better regarded as a subgenus, for the armature in question is merely a collection of small rods which strengthens the labial cuticle, and, unless it is much developed, is not a conspicuous or important character. The following species have been described:—

1. *P. atromaculata*, B. Mediterranean.
2. *P. crucis* (Oersted). West Indies. = *P. Sawagei*, Rochbr., Cape Verd.
3. *P. Mauritanica*, B. Mauritius.

4. *P. angulata*, Eliot. E. Africa.
5. *P. aurea*, Eliot. E. Africa.
6. *P. rubescens*, B. Malay Archipelago.

Rochebrune (Nouv. Arch. du Muséum d'Hist. Nat. Paris, 1881, ser. II, vol. iv, p. 263) has described a species from the Cape Verd Islands as *P. Sauvagei*, though without any indication of its internal characters. It is probably only a variety of *P. crucis*, which has a green back, spotted with black, and black rhinophores, whereas *P. Sauvagei* is of a uniform green, with violet rhinophores. Both have yellow branchiæ.

PELTODORIS sp.

Mr. Crossland's notes on the living animal are as follows:—

"Dorid, yellow. Porto Praya.

"Back covered with small papillæ. 8 rather small, abruptly-ended, dark red-brown gills. Rhinophores with a few red-brown dashes. Colour deep yellow, with numerous small reddish brown blotches, appearing to the naked eye deep orange. Under side nearly white. Elongated in shape, with narrow mantle. Foot rather high."

The single specimen is hard and stiff, rather flat, but the back is somewhat arched. It is much bent, but the dimensions are—length about 12 mm., breadth about 6 mm.

The integuments are full of white, rod-like spicules, fairly straight, and of various sizes. The back is covered with little spiculous tufts, as in *Rostanga Evansi*, but lower and less conspicuous. The edges of the rhinophorial and branchial pockets are not raised, but the surrounding surface forms a sort of hillock. The foot is grooved in front, but apparently not notched. The tentacles are small knobs. The eight branchiæ are dark brown, stout, short, scanty, and apparently bipinnate.

No labial armature was found, and the labial cuticle seems clear and transparent. The radula consists of 52 rows, of which the two hindmost are in process of growth and hardly formed. Each row contains 70–80 teeth on either side of the bare rhachis. The teeth are hamate and very stout. The innermost are smaller.

This specimen seems to belong to the genus *Peltodoris*, but is hardly referable to either *P. atromaculata* (Mediterranean) or *P. crucis* (Antilles). It is probably immature, and it is, perhaps, not worth while to create a new species for it.

ROSTANGA, Bergh.

This genus resembles *Geitodoris* in many respects, but differs in having a prostate and simply pinnate branchiæ. The back is covered with small tubercles, from which spicules project. Hitherto it has been recorded only from cold and temperate seas. The species are:—

1. *R. coccinea* (Forbes). Atlantic and Mediterranean.
2. *R. perspicillata*, Bergh. Mediterranean.
3. *R. pulchra*, MacFar. California.
4. *R. rubicunda* (Cheeseman). New Zealand.
5. *R. Evansi*, n.sp. Cape Verd Islands.

This new species is of a violet grey, but in all the others the prevailing coloration is red.

ROSTANGA EVANSI, n.sp. Pl. XIV, Figs. 6a-6c.

Mr. Crossland's notes on the living animal are as follows:—

"Of a light violet grey. Back covered with minute papillæ. Numerous round darker spots, edged with a whitish line, looking exactly like pits, but, when touched with a needle, seen to be in same plane as rest of surface. These are largest where the mantle passes into the visceral hump. A few papillæ are longer than the rest, and opaque white. Rhinophores also largely white, and a row of white dots is placed round the mantle-edge. Gills simply pinnate and of fair size, 9 in number, of same colour as the body, with pointed ends. They are symmetrically placed round the anus.

"Rough and rather stiff. May be flat in shape, or may take on a high form with flat back. Mantle ample. Foot moderately broad; grooved and notched; very strongly adhesive; whitish in colour.

"Aug. 11th. A small damaged specimen presumably of same species.

"Aug. 17th. St. Vincent. Small specimen from the bottom of the lighter."

The specimen dissected is 14 mm. long, 9 broad, and very flat. The ample mantle completely covers the foot, and is in some places 3.5 mm. wide. The foot, as preserved, is not very distinctly grooved, and has expanded lateral margins. No tentacles were found. The texture is fragile and spiculous. The back is covered with papillæ about a quarter of a millimetre high, generally slightly broader at the top than at the base. Each papilla is supported by a bundle of spicules, set within it vertically, three or four of which project from the top. The intervening dorsal surface is also crowded with spicules. The spicules are all colourless straight rods.

The labial armature consists of yellowish rods, somewhat curved, with thickened ends. The radula is fragile and difficult to keep together. It seems to consist of 18 rows, with a formula of 20 . 0 . 20 or less. The innermost teeth are comparatively small; those in the middle of the half-rows are taller (Fig. 6a). Near the end of the row are about five long and very thin teeth (Fig. 6b), but the two or three outermost are shorter, though thin, and bear 2-3 longish denticles below the tip (Fig. 6c).

No armature was found in the reproductive organs.

The largest specimen (15 mm. long by 9 mm. broad) looks somewhat different, as the dorsal papillæ are relatively much longer and more conspicuous in the smaller specimens. But though the back of this larger specimen appears to be merely minutely granulate, the structure of the granulations and spicules is the same as in the others.

CADLINA CLARÆ, von Ihering, juv. Pl. XIV, Figs. 7a-f.

Cadlina Claræ, von Ihering: Malac. Blätt., 1880, vol. ii, pp. 107-110.

Mr. Crossland's notes on the living animal are as follows:—

"Dorid, minute white.

"Among washings of Nullipore nodules and coal, 5 fathoms or thereabouts. Oblong shape, narrow mantle, and high foot like *Chromodoris*.

"Rhinophores very large, deep chocolate colour, perfoliate in whole visible length, completely retractile, though with difficulty. Gills same colour and appearance, very small, not a quarter of the size of the rhinophores, simply pinnate, 3 in number, all placed anteriorly to the anus, on a broad base. The body is a translucent white, the light brown liver and whitish genitalia showing through. There are a few opaque white spots in the skin, especially at the junction of the mantle and the visceral mass. Two clear black eyes show through some little way behind the rhinophores."

The larger of the two preserved specimens is 4.5 mm. long, 2.5 mm. broad, and rather flat. Otherwise it is just as described above. The contrast between the dark-brown rhinophores and branchiæ and the white body is very remarkable. The rhinophores are very large. The three gills are everted, but appear to be completely retractile into a small round pocket. Strictly speaking, only the ramifications of the branchiæ are brown, the main rhachis being white. The dorsal surface is minutely granulate. There is a ring of rod-like spicules inside the integuments round the mantle-rim, but in the centre of the back there seem to be no spicules. The mantle-margin is fairly wide; the foot rather narrow, grooved and notched in front. A large blunt prominence on either side of the mouth perhaps represents a tentacle. The large dark rhinophores are visible right through the body, and can be seen from the lower side.

There is a labial armature composed of minute mace-shaped elements. The radula consists of 71 rows of teeth. The central tooth is a plate bearing four longish denticles on its upper edge, which point backwards. The first lateral has a larger base and bears six denticles, of which the third from the inside is the largest. In the succeeding teeth this large denticle increases in size, the denticles to the inside of it disappear, and those to the outside become more numerous. Fig. 7 will show how the plate-like median tooth and the hamate, denticulate, lateral teeth are connected by a complete series of intermediate forms. As in the specimens examined by von Ihering, no armature was found in the genitalia.

These specimens are probably the young of *C. Claræ*, which is recorded from Naples, and is perhaps itself not full-grown, as it is only 10 mm. long. The most striking characteristic of the species is the contrast between the white skin and the dark colour of the rhinophores and branchiæ. A similar contrast is found in *C. flavomaculata*, MacFarland, from the Californian coast, which is white, with pale-yellow spots, and large black or brown rhinophores.

For a list of species see Cockerell & Eliot, Californian Nudibranchs, Journ. Malac., 1905, vol. xii, p. 34.

CHROMODORIS, A. & H.

This genus is very abundant in the tropical Indo-Pacific, and is remarkable for its brilliant coloration and elaborate patterns. It extends as far north as Japan and Puget Sound, and as far south as Tasmania and New Zealand. In European and Atlantic waters the records are relatively scanty, about ten species being known from the

Mediterranean and five from the West Indies. None appear to have been found north of the Mediterranean. Compared with the Pacific forms, these species are soberly coloured, the majority being blue or purplish, with white or yellow markings.

One small blue species was found in the Cape Verd Islands, and is already known from the Mediterranean.

CHROMODORIS GRACILIS (Delle Chiaje).

Chromodoris gracilis (Delle Chiaje), von Ihering: Malac. Blätt., 1880, vol. ii, pp. 67-71.

Mr. Crossland's notes are as follows:—

“*Chromodoris* (blue). In a nodule of *Lithothamnion*, 3 or 4 fathoms. “Of the typical shape, with narrow mantle, about an inch long, foot projecting very little behind mantle. Colour deep blue, almost black, except edges and anterior part of mantle which are bright blue. Parallel to mantle-edge, a thin line of bright yellow. In centre of back a long zigzag line of white, bearing club-shaped or semicircular blotches of light blue laterally. This line is yellow between and in front of the rhinophores. Foot blue-black above, lighter blue below, with white and light blue blotches. Just below mantle a thin bright yellow line. The whitish blotches are largest above, smaller below, and are arranged in 3 rows. Formalin dissolves out a blue solution. Gills 7 in a simple circle, hindmost pair rather smaller, simply pinnate, completely retractile and not reappearing for some time. The plumes are dark blue, with white tips, and white blotches on outer side of rhachis. They spring from a blue-black base. Rhinophores large, almost as high as the gills, black with white tips, and a few white dots.”

The preserved specimens are of a uniform grey. The largest is 9 mm. long, 3.5 broad, and 4 mm. high. The mantle-edge is indistinct; the head and tentacles as usual in the genus. The branchial pocket is not raised, and the plumes are completely retracted within it. The foot is narrow.

The labial armature is a fine yellowish mosaic of rods with bifid tips. The radula consists of about 50 rows, with from 35 to 40 teeth on each side of the naked rhachis. The arrangement of the teeth is as usual in the genus. They are minute and deeply cleft at the top. Under the cleft they bear a few (1-3) fine denticulations. There may perhaps be as many as 5 denticulations, but they are hardly visible.

In most points this specimen corresponds exactly with von Ihering's description of *C. gracilis*, but the three yellow lines on the back are replaced, according to Mr. Crossland's description, by one long “zigzag line” of white and yellow.

DORIDOPSIDÆ.

This family is divided by Bergh into the genera *Doridopsis* and *Doriopsilla*. The former is numerous in species, and its known distribution is much the same as that of *Chromodoris*. It is abundant in the tropical Indo-Pacific, and the animals are often large and

brightly coloured. Five species are recorded from the Mediterranean and Atlantic, and immature specimens of one of them (*D. grandiflora*) have now been found in the Cape Verd Islands.

Doriopsilla is distinguished by its harder consistency, but especially by having the buccal ganglia close behind the pedal ganglia, and not some distance further back, as in *Doridopsis*. Bergh thinks this indicates that the conformation of the anterior digestive tract is not really the same in the two genera. Five species have been referred to *Doriopsilla*.

1. *D. areolata*, Bergh. Atlantic; Mediterranean.
2. *D. (?) granulosa* (Pse.). Sandwich Islands.
3. *D. pallida*, Bergh. Siam.
4. *D. Pelseneeri*, Oliveira. S. Portugal.
5. *D. (?) laevis*, Bergh. Malay Archipelago.

DORIDOPSIS GRANDIFLORA, juv. (Rapp).

Doridopsis grandiflora (Rapp): Von Ihering, Mal. Blätt., 1880, vol. ii, p. 104; Bergh, Jahrbüch. deutsch. malak. Gesell., 1880, vol. vii, p. 310, pl. x, fig. 8; pl. xi, fig. 2.

The notes on the living animals are as follows:—

“Two specimens found together under a stone, Porto Praya.

“Rather narrow in shape. Perfectly soft and smooth, with a conspicuously delicate mantle, fairly wide, always much waved in outline and mobile, translucent and marked by colourless lines radiating from the visceral mass. Ground colour yellow in one specimen, pinkish yellow in another. On the visceral mass this is plentifully besprinkled with dark grey blotches and a few smaller ones of dark red brown. 8 large delicate triplunate gills tipped with white, as also are the rhinophores. Gills are not covered when retracted, and the edge of the gill-pocket is thick and low. Rhinophore-pocket has raised edge closely fitting to the rhinophore.”

The preserved specimens agree fairly well with Mr. Crossland's notes, but are much contracted and bent, the head-parts, in particular, being greatly distorted. The largest is about 10 mm. long, 9 mm. broad, and 8 mm. high. The skin is smooth, soft, and without a trace of tubercles or prominences.

The intestines are yellow, and the liver deeply cleft behind. The digestive organs and nervous system as usual in the genus. The œsophagus is considerably twisted, and forms a complete loop. In spite of a careful examination, the usual armature of hooks on the glans penis could not be found with certainty in either specimen, though there seemed to be some minute rods or scales in the lower part of the vas deferens.

This is probably a young specimen of *D. grandiflora*, which, when adult, is as much as 9 centimetres long. The best external character of the species is afforded by the lines radiating from the visceral mass to the border, as mentioned by Mr. Crossland. It is possible that the armature of hooks on the glans penis is only developed in the older specimens.

DORIDOPSIS PELSENEERI (?), AREOLATA (?).

(See Oliveira, "Opisthobranches de Portugal," Coimbra, 1895, p. 12; Bergh, Jahrbüch. deutsch. malak. Gesell., 1880, vol. vii, p. 316; id., Zool. Jahrb. Syst., vol. ix (1896), p. 454; Vayssière, Expéd. scient. "Travailleur" et "Talisman," 1902, p. 235; id., Ann. Mus. Marseille, 1901, vol. vi, p. 50, pl. vii, figs. 8-10.)

Mr. Crossland's notes on the living animal are as follows:—

"From a tidal pool, well above the low tide level. The slug exposes itself to the sun. Very flat in shape, with ample mantle. Rather rough and stiff to the touch, but not remarkably so. Back warty. Gills 3, tripinnate. They often appear to be rather small, but can be expanded to a very ample size. Edges of the gill and rhinophore-pocket distinctly raised, especially the latter.

"In crawling, the foot just visible behind the mantle.

"Colour brilliant yellow, but the four specimens vary in the depth of their colour, according to their size. The smallest has a mere tinge of light yellow, but the gills, and especially the rhinophores, are distinctly yellow. The largest is a very deep yellow, and the rhinophores are almost brown. Some of the warts are sand-coloured. Under side rather lighter in colour. Foot very broad. The heart can be seen pulsating, and the gills move in time with it. In the largest specimen there are five gills. Mantle-margin wavy."

The largest of the preserved specimens is about 20 mm. long, 12 mm. broad, and 5 high. The external characters are as described. The back is covered with tubercles, but they are flatter and less noticeable in the centre. This, however, may be due to accidental external pressure. The mantle-edge is ample and thin, with an internal reticulate pattern, which can be seen from the under side. It is formed of spicules arranged in bundles, which anastomose, and are so distinct that they actually project as ridges. Many of the spicules have a prominence on one side, and are sometimes almost Y-shaped. The whole arrangement resembles that found in the Californian *Doridopsis reticulata*. The foot is broad, with expanded margins; it is rounded before and behind, but no anterior groove is visible. The branchiæ are five in the largest specimen. Two small and indistinct lobes above the mouth seem to represent the oral tentacles.

The digestive tract is much as described by Vayssière for *D. areolata*. The tube which issues from the buccal cone is bent on itself and describes a complete circle; it then passes through the nerve collar, runs backwards, and, after becoming very thin and constricted for a short space, dilates into a small round pouch. It is ringed or striated transversely for its whole length. The round pouch is succeeded by another constriction and a sausage-like dilatation.

The glans penis is armed with hooks. They have rather broad bases, and are of irregular and sometimes rather wavy outline.

The central nervous system is enclosed in a hard capsule. The ganglia are more distinct than is usual in the Doridopsidæ, but lie close together so that the commissures are short or absent. The eyes

are sessile. The olfactory nerve is long and the distal olfactory ganglion distinct. Close behind the pedal ganglia lie the buccal ganglia, which touch one another as in Bergh's figure.

These specimens have most of the characters of *D. areolata*, Bergh, and in particular agree very nearly with Vayssière's description of the specimens obtained by the "Talisman." But the reticulation on the back between the tubercles, noticed by all previous authors, is not visible in the preserved specimens or mentioned by Mr. Crossland. Possibly they are the *Doriopsilla Pelseneeri* of Oliveira (l. c.), which is said to resemble *D. areolata*, but to have no reticulations and to be red or yellow in colour. But it is also said to be very convex, and to bear large tubercles of varying size on the back. It may be that these specimens, the typical *D. areolata* and *D. Pelseneeri*, are all varieties of one species, which must be called *D. areolata*. The animal's habit of exposing itself to the sun is remarkable.

In any case, it is clear that closely allied forms of *Doriopsilla* are widely spread in the Western Atlantic and the Mediterranean.

PLOCAMOPHERUS, F. S. Leuckart.

(See Bergh: Semper's Reisen, Heft xi, pp. 431-439, and Heft xvii, pp. 949-959.)

The genera *Plocamopherus* and *Euplocamus* form a small but distinct group of the Polyceridæ. Externally they are characterized by their flat, ridge-like oral tentacles, and by having branched processes on the oral veil, dorsal margin, and sometimes on the sides of the body. Internally both the buccal parts and the genitalia are distinctive. Mandibular plates are present. The rhachis of the radula is bare and very wide; some (3-11) of the inner teeth are large and hamate, or spoon-shaped; the remainder are flat plates. There is a large and remarkable dendritic prostate which envelops the spermatheca.

Plocamopherus is distinguished from *Euplocamus* chiefly by having a large frontal veil and a large crest on the tail. These developments no doubt assist the animal to swim, and mean that it is specially modified for an active life. Some of the species (especially *P. Tilesii*) have a broad laminated groove in the front part of the foot, which perhaps enables them to cling at this point, while the body floats freely. The species described are: (1) *P. ocellatus*, Leuckart; (2) *P. Maderæ* (Lowe); (3) *P. Tilesii*, Bergh; (4) *P. Ceylonicus*, Kelaart (perhaps = *P. navatus*, Abr.); (5) *P. imperialis*, Angas; (6) *P. Amboinensis*, Bergh; (7) *P. indicus*, Bergh; (8) *P. insignis*, E. A. Smith; (9) *P. levivarius*, Abr.

P. (Histiophorus) maculatus, Pse., and *P. (Polycera) ramulosus*, Stimpson, are more doubtful forms. The species are fairly well distinguished both by the number and character of the dorsal appendages and by the number and shape of the teeth. All are recorded from the Pacific only, with the exception of *P. Maderæ* from the Atlantic and *P. levivarius* of unknown habitat.

The type species is *P. ocellatus* from the Red Sea, whose external features were briefly described by Leuckart. I have examined some specimens of this form brought by Mr. Crossland from Suakim, and

find that, in internal as well as external characters, they agree with the other members of the genus. The body is chocolate colour, with yellow ocelli; the dorsal margin bears three pairs of processes which show little sign of ramification, but those on the oral veil are said to have been branched in life, and the crest on the tail was a great fleshy hump. The formula of the radula is 21×9 (or 10) $+ 3 \cdot 0 \cdot 3 + 9$ (or 10). The rhachis is very wide and divided into areas by transverse divisions. The characteristic reticulate prostate is well developed.

Probably all the species can swim. This is specially recorded of *P. Maderæ*, *P. Ceylonicus*, and *P. maculatus*.

PLOCAMOPHERUS MADERÆ (Lowe). Pl. XIV, Figs. 8, 9.

Peplidia Maderæ, Lowe: Proc. Zool. Soc., 1842, p. 51.

Mr. Crossland's notes on the living animal are as follows:—

“Two specimens from the bottom of a large rowing boat which was covered with Hydroids and Polyzoa. Larger specimens about $2\frac{1}{2}$ inches long, of a high, narrow shape. Foot narrow, but can adhere strongly. Tail especially high, and has a kind of crest along the top. Gills can be counted as either 5 or 3; tripinnate. Finest branches nearly colourless; very mobile and contractile, but not retractile into a pocket. Body bears three pairs of branched sand-coloured processes, about $\frac{1}{3}$ inch long; branches very small, pointed, and with bright yellow tips (this colouration only visible under a lens). Laterally there are a few scattered papillæ of the same kind, but smaller. The dorsal ones are placed thus: 1st pair one-third distance between rhinophores and gills, 2nd pair $\frac{1}{4}$ inch anterior to gills, 3rd, which bear a few small branches, $\frac{1}{4}$ inch behind gills. Rhinophores perfoliated and retractile (though not readily so) into pockets, the tips of which stand up to form a tube, so that only the perfoliate part of the rhinophore is ever visible. Just postero-laterally to the rhinophores commences a peculiar membranous expansion of the head. This membrane is undulated at the margin, and bears a row of branched projections like tassels. These are tipped with bright yellow, and in this, as in their form, they resemble a further development of the branches of the dorsal papillæ. The apparatus is mobile and sensitive to touch. The colour of the animal is a red orange, almost vermilion. Under the lens this does not appear homogeneous, but as a yellow orange ground colour with dark red specks, and larger spots of vermilion. The colour is deepest dorsally. The margins of the root, which are spread out as an adherent membrane over the substratum, are colourless, with yellow spots and darker specks of brown. The body is very soft and translucent. The small specimen was very much paler and yellower in colour, the dorsal papillæ being bright yellow, as were the tassels of the head-membrane and the ridge of the tail. The big specimen was directly placed in a mixture of alcohol and formol, and contracted very much. The smaller, killed in glacial acetic acid, is comparatively little changed, but the head-membrane is no longer distinct as such. In life it projected freely for at least a $\frac{1}{4}$ inch in the big specimen.

"Two small specimens were obtained later, from one to five fathoms at some distance off the shore."

The preserved specimens are of a uniform greenish grey. The largest is 24 mm long, and 12 mm. high at the highest point. The breadth is about 9 mm. across the oral veil, and 7.5 across the back. The oral veil is semicircular, and bears on its margin numerous small processes. Fifteen of them are rather larger than the rest and bear minute branches or knobs. Over the mouth are two ridge-like tentacular folds, about 3.5 mm long. The dorsal margin bears three appendages on either side: two pairs between the rhinophores and branchiæ, and one just behind the branchiæ. They show traces of short ramifications and yellow pigment. Below, on the sides of the body, are the remains of a number of smaller lateral processes, which have become somewhat obliterated. On the left side, where they are best preserved, twelve can be made out, apparently arranged in two lines. The rhinophore-sheaths are connected with the oral veil. They are not very high, and have smooth edges. The caudal crest is raised about 2 mm. above the main mass of the tail. As preserved, its edge is smooth. The branchiæ are tripinnate, with a strong rhachis. They can be counted as either 3 or 5. The anterior plume is separate, but the two posterior plumes on either side are connected at the base. The foot is narrow, and a laminated groove is not visible in any of the specimens.

The smaller specimens are only about 12 mm. long, but seem to have preserved their shape better. The processes on the oral veil, dorsal margin, and sides are more distinct, and relatively larger. There are also a few processes on the caudal crest. But it would appear that the animals cannot have been very ramose in life: not, for instance, like *P. Ceylonicus*.

There is a labial armature of two reddish triangular plates, composed of small thickly packed thread-like rods. The radula (Fig. 8) consists of 15 rows which have a formula of $10 + 4 . 0 . 10 + 4$. The rhachis is remarkably wide, and divided by transverse lines connecting the rows on either side. The four inner teeth of each row are hamate and somewhat spoon-shaped (Fig. 9). The base is large, and in the innermost tooth so strongly developed that the tooth appears bifid, or produces an illusion of being two teeth. The ten outer teeth are plate-like, and occasionally an eleventh rudimentary tooth is present.

The œsophagus is short, and enters almost immediately the fairly large stomach, which lies in an anterior cleft of the liver, but is not enclosed in the liver. The intestine is fairly long. The buccal mass, œsophagus, and intestine are greenish, the stomach brown. The liver is long, and extends into the tail. It is divided by a cleft into an anterior and posterior portion. Internally it is of a deep chocolate brown. Externally it is lighter, being covered by a white layer of the hermaphrodite gland.

The blood-gland is white and not conspicuous. The central nervous system is white and of a fair size. The cerebro-pleural ganglia touch one another behind, but diverge somewhat in front. The cerebral and pleural portions are not distinctly divided, but the posterior half

shows indications of being a round body fused with a less regular and somewhat oblong body in front. The pedal ganglia are roundish. The eyes are large and black. From the indistinct proximal olfactory ganglia runs a longish and thick connective to the rather large distal olfactory ganglia.

The vas deferens is strong, thick, and convoluted. Into it opens at some distance from its termination the whitish flocculent ramoso prostate, which is also spread over the spermatheca. The spermatheca is very large and globular, greenish, but filled with brown matter. The spermatocyst is small and pear-shaped. The termination of the female branch is very thin. The penis is exerted. The external organs consist of folds of skin and a curved cylindrical tube, nearly 5 mm long if straightened out. The glans bears hamate spines somewhat resembling the teeth of Dorids, set in numerous regular rows.

This animal is, I think, clearly Lowe's *Plocamopherus* (*Peplidia*) *Maderæ*. He mentions that it swims like the larva of a gnat, and is brilliantly phosphorescent.

DOTO OBSCURA, n.sp. Pl. XIV, Fig. 10.

Five specimens described as coming from washings of seaweed and Pennaria. The notes on the living animals say that the colour as a whole was reddish brown in the small specimens and black or dark grey in the larger. The body was of a very dark grey, almost black, but the shade varied, forming a mottled pattern. The cerata were thick, of a red-brown colour, the tubercles black, or, in small specimens, dark grey. The rhinophore-sheaths were large, with anteriorly expanded rims, the lip being very mobile.

In the alcoholic specimens the body is mottled purplish black, with lighter markings. The cerata are yellowish, with large purplish black spots at the end of the tubercles. The foot is yellowish.

The largest specimen is 7 mm. long, and 4 broad across the cerata. There are seven pairs of cerata, of which even the last bear tubercles, and are not mere warts. Their form is rather irregular; the terminal tubercle is generally remarkably well developed, but sometimes atrophied. As a rule the tubercles are set in four rows—4 (rarely 5) in the topmost row, 5-6 in the middle rows, 4-5 in the two lowest. The tubercles on the inner side of the cerata are often imperfectly developed. The dimensions of the largest cerata are 3×1.5 or 3×2.5 mm.

The yellow and conspicuous anal papilla is on the right-hand side between the first and second cerata, but further inwards. The genital orifices are under the first of the cerata, on the right-hand side. The rhinophores are white; their sheaths are black, and have the anterior margin expanded and prolonged (Fig. 10). In front of each of the sheaths is a tubercle. The oral veil is rounded, fairly ample, entire, with a yellowish rim.

The jaws are very thin and membranous. The radula consists of a single series of 72 teeth, fairly broad, with a moderately high central cusp and two or three not very distinct lateral denticles. The intestines are yellowish.

It is with considerable hesitation that I create a new species for this form. The important differences in the genus *Doto* are small, and the species are very variable. Still, the five specimens collected by Mr. Crossland all agree in having a distinctive coloration, and a remarkable shape of the rhinophore-sheaths, which is perhaps constant. They present some resemblances to *Doto Africana*, Eliot, and *Doto splendida*, Trinchese. But it is *primâ facie* not likely that the species found on the east and west coasts of the African continent are identical, and Bergh suggests that *Doto splendida* is the same as *D. pinnatifida*. I do not think that this species is the same as *Doto pinnatifida*, for the skin is smooth, whereas in *D. pinnatifida* it bears small tubercles on the back and sides.

DOTO CINEREA, Trinch.

Doto cinerea, Trinchese: *Æolid.* Porto di Genova, pt. ii, p. 92, pl. lv, fig. 1; Vayssière, *Ann. Mus. Marseille*, vol. iii, No. 4, p. 102, pl. ii, figs. 5-5b (1888).

Two specimens from Porto Praya, Cape Verd Islands, found on *Sertularia*.

The notes on the living animals say they were narrow and elongate, square-cut in front, and tapering behind. The larger specimen had four symmetrical pairs of cerata; the smaller, five irregular sets. These consisted of (1) a regular pair, (2) a pair consisting of a large cera on the right and a small one on the left, (3) similar to the last pair, but the large one on the left and the small one on the right, (4) one only on left, (5) one median. The colour was dull dirty yellow, covered with irregular blotches of black, especially in the mid-dorsal area. The edges of the velum and of the rhinophore-sheaths bore clear, opaque white dots. Liver branches drab yellow. The tubercles on the cerata were blue and black in the smaller specimen, bluish-white in the larger.

The preserved specimens answer to this description. The largest is 4 mm. long, and its largest cerata 1 mm. high. The tubercles on the cerata are rather elongate and irregularly arranged. In the larger specimen their tips are white, with a dark band below this white part. The rhinophore-sheaths are rather long, with slightly crenulate edges. The general colour of the animals is yellowish, with numerous blackish or brown spots, which are particularly thick down the centre of the back. The foot and the rims of the rhinophore-sheaths are yellow. The foot is broad. The buccal parts are as described by Vayssière. The teeth have two or three irregular and indistinct denticles at the sides of the median cusp.

This appears to be the *D. cinerea* of Trinchese, recorded from Genoa and Marseilles. As these specimens seem rather darker than those previously described, they may perhaps be called var. *nigromaculata*.

SPURILLA NEAPOLITANA (Delle Chiaje).

Spurilla neapolitana (Delle Chiaje), Bergh: *Verhandl. zool.-botan.* Wien, 1882, vol. xxxii, p. 13, pl. i, figs. 10-21; Vayssière, *Ann. Mus. Marseille*, vol. iii, No. 4, p. 112, pl. v, figs. 71-79 (1888).

Mr. Crossland describes specimens, which probably belong to this species, under two headings, here called A and B, adding that the two sets are very much alike but differ in details of coloration.

A. "When crawling almost vermiform, foot tapering, but no tail. Tentacles longer than rhinophores. Rhinophores short and perfoliate; yellowish white; in one specimen a little yellow colour basally. Foot expanded and grooved in front, but not drawn out. Ample margins laterally. Cerata regularly tapering and curved; set in rather oblique transverse rows. Ten rows in all, but, seen from the side, the cerata spread out fan fashion. Body and appendages sprinkled with white specks; transparent, so that pink organs in body and slender brown liver diverticula show through. A little pink colour about mouth. Collected under a stone and from bottom of lighter."

B. "Under a stone from the shore. Tentacles and rhinophores about the same length. Latter with about 10 distinct perfoliations. Body slender, cerata long. Foot narrow, dilated and grooved in front, but corners not at all drawn out. Cerata in six transverse rows. The largest cerata are the median ones of the third set. Formula of arrangement :—

3	3	}	close together.
3	3		
5	5		
4	4		
2	2		
1	1		

Body largely colourless and translucent. Large light lilac patch on head between tentacles and rhinophores. Light tint of same on distal half of tentacles. Distal half of rhinophores yellow. Row of large yellowish white blotches along back. A pair of orange yellow streaks on the head. Liver light brown.

"The animal is very active."

The largest specimen belongs to set A. It is not much more than 12 mm. long, but somewhat bent, and about 4.5 broad. The smaller specimens are more slender in proportion. As a rule the cerata are set in about six groups, but, in the largest, only four are distinct, the remaining cerata being crowded together on the tail. The first, third, and fifth rows, generally, are inclined somewhat towards the head, the second, fourth, and sixth, somewhat towards the tail, but the cerata do not seem to be arranged in definite horseshoes, as in some forms. The rhinophores and tentacles are both short, the former strongly perforate. The anal papilla is situated on the side, behind the second row of cerata. The genital orifice lies in front of it, under the first row. The foot is rounded in front.

The pale yellow buccal mass is somewhat flattened and compressed. The jaws bear fine but rather irregular denticles on the edges. There is some discrepancy in the statements of previous authors as to the presence or absence of these denticles. It is probable that the edge of the jaw is originally denticulate, but becomes worn smooth with age. The radula consists of 14 pectiniform teeth. They are not bilobed, but

there is always one low denticle in the middle which divides them into two halves. On either side of this median denticle are 30-45 longer ones. They are fairly regular and straight.

No essential differences could be found between these specimens and those marked B. The latter are smaller (the largest 5 mm. long and 3 broad), but have larger and more inflated cerata. The radula of the specimen dissected consisted of 11 teeth, which had somewhat fewer denticles on each side (25-30), and were perhaps bent into a somewhat narrower arch.

All the specimens of both sets are white, as preserved, and I think all can be referred to *Spurilla neapolitana*. They are probably immature, for the species attains a length of about 4 cm. in the Mediterranean, and, this being so, one cannot be sure that they represent distinct colour varieties in the adult. It would appear from Vayssière's figure of one of the cerata (l.c., 9a), that they are covered with minute, white dots, as in these specimens.

AMPHORINA PALLIDA, n.sp. Pl. XIV, Fig. 11.

Only one specimen preserved. Mr. Crossland's notes are as follows:—
"Æolid. 26/7/04.

"On a stone which was coated with *Spirorbis*. In these surroundings, not visible to the naked eye, but this probably an accidental circumstance.

"Elongated, but foot is as broad as the ventral surface. No pedal tentacles. Oral tentacles rather thick and blunt, about half as long as the rhinophores. Latter not perfoliated and (like the cerata) blunt and thick at the tip. Whole dorsal surface and its appendages snowed over with pure white pigment, the brown liver only showing at the narrowed bases of the cerata. There is, besides, a pair of clear areas above the eyes, postero-laterally to the rhinophores. Ring composed of bright orange-red dots, half way up the rhinophores, and the oral tentacles have a similar colour, less definitely arranged. Foot ends in a long slender transparent tail. Cerata in four sets, of which the third is the largest and contains the longest cerata. Each set consists of but two cerata. The first pair have three or four red specks anteriorly."

The preserved specimen is white, 3.5 mm. long, and stoutly built. There are only two cerata in each of the four rows. They are inflated, and the largest are about 1.5 mm. high. The other external characters correspond with the description of the living animal.

The jaws are very thin, and hardly visible. I could not make out any denticles on the masticatory edge. The radula consists of a single row of about 80 teeth. As in *Amphorina cœrulea* (see Vayssière, l.c.), the teeth are of different sizes, about 35 being large and 45 small. They are of the horseshoe shape, but somewhat asymmetrical. They bear a strong median denticle, which rises rather far back, and three lateral denticles only, on each side (Fig. 11).

No stylet or chitinous tube could be discovered on the penis, but its absence cannot be regarded as certain.

This specimen is perhaps immature, but it seems to be sufficiently

characterized by its pale coloration, by having only two cerata in each row, and by the small number of lateral denticulations on the teeth.

PHIDIANA LONGICIRRHA, n.sp. Pl. XIV, Fig. 12.

One specimen. Mr. Crossland's notes on the living animals are as follows:—

“Crawled out of stones dredged in shallow water off the north shore, Porto Grande. Body narrow, and foot pointed behind, but not forming a tail. Translucent white, with a few collections of white specks. Foot with expanded angles in front, but not tentaculiform, grooved, but groove widely open above to the mouth. Oral tentacles conspicuously long, and generally hooked back at the tips, but, on the whole, carried at right angles to the body. Rhinophores much shorter, but still long, brownish yellow in colour, perfoliated almost to the bases. Fairly conspicuous eyes just behind. The colourless liver diverticula all well seen, and behind is the heart beating. In the cerata the liver becomes darker in colour, but slender and drab brown, forming a thread of black distally.

“The median cerata are long and tapering, and the ends are carried bent over downwards; they are very mobile, and, probably in connection with this, are delicately ringed. They have a considerable amount of yellow pigment in the skin as well as in the liver diverticula; also some whitish specks.

“Their arrangement is in two sets as follows:—The back is bare in the middle, and the cerata are arranged in two sets, in a longitudinal band on each side. The first set begins just behind the rhinophores, with some laterally placed, small, straight cerata. The row is three or four deep further back, containing three of the long curved cerata in a longitudinal row in the middle, shorter nearly straight ones laterally, and very small quite straight ones outside. After a distinct bare space, a similar arrangement is repeated, but the longest cerata are shorter, and there are only two on each side. After this are small scattered cerata to within a short distance from the tip of the tail.

“The arrangement might also be described as sets of obliquely placed, transverse lines, becoming quite transverse in the second set. But there are no projections of the body to support the cerata.

“Another specimen from *Alcyonium*.”

Only one of the specimens preserved really belongs to this species, the others being *Spurilla neapolitana*, which have found their way into the bottle by mistake.

The single specimen agrees with the description as far as the characters can still be recognized. It is 9 mm. long and 3 broad, somewhat compressed laterally. The cerata are arranged as described, and still show traces of annulation (Fig. 12). The longest measure 6 mm., and are very thin; the outermost are mere tubercles. The liver-diverticula within them have a very irregular outline, and sometimes appear twisted. The endo-sacs are large. The oral tentacles are stout and strong. The anterior end of the foot is rounded, as preserved, and the angles are not visible.

The jaws bear a single row of large distinct denticles. The radula is uniseriate, and consists of 22 teeth, which have a strong central cusp and 4-5 long, distinct, clear-cut lateral denticles. The denticles do not extend up the sides of the cusp.

No spine or hook was found on the verge.

This animal does not seem referable to any described species of *Æolid*, and the long annulated cerata form a remarkable character which will probably render its recognition easy. I refer it somewhat doubtfully to *Phidiana*, though it does not seem to possess the armature on the male genitalia which Bergh considers characteristic of the genus.

FACELINA DRUMMONDI (Thompson).

Eolis Drummondii, Thompson: Alder & Hancock, Brit. Nudibranch. Moll., Fam. 3, pl. xiii.

Facelina Drummondii, Bergh: Verhandl. zool.-botan. Wien, 1874, vol. xxiv, p. 400.

Four specimens. Mr. Crossland's notes on the first two are as follows:—

“*Æolids*, from the bottom of a big rowing boat.

“The larger specimen rather less than 1 inch long; proportionately broad, but tapering posteriorly. Body translucent, cream colour, with a few whitish opaque markings. Cerata rather small, of uniform thickness, coloured drab brown by liver, but end sac is transparent and colourless. The parts around the mouth, the penis (protruded in several), and the anterior groove of the foot, are pink. At the neck a crimson organ shows through. Two small black eyes. Rhinophores bright orange at base, dying out to light yellow in the deeply perfoliated part. Anterior tentacles long and mobile. The shorter rhinophores stand stiff and upright some little distance behind. Foot has a groove and notch, angles drawn out, but hardly tentacle-like. Sides of foot form delicate membranes, tail long and slender. This appears to be damaged more or less, or broken off in all but one specimen.

“Cerata arranged in groups on laterally placed swellings of body-wall.

“One specimen had five groups containing 11 . 9 . 8 . 6 . 6 cerata respectively, but some were lost posteriorly, and in any case were very small.”

Of the other two specimens he writes:—

“Porto Praya. Under a stone with Polyzoa. Cerata very dark drab brown, then dark red just below the whitish end sac. In one specimen the liver is much redder than in the other.”

The preserved specimens correspond with these descriptions as far as the characters are still recognizable, but are somewhat thicker and stouter, doubtless owing to contraction, the largest being 8 mm. long and 3.5 wide. The cerata are small and bent, the largest 2 mm. long, the smaller minute. They are very caducous, and appear to be set in curved lines on slight prominences. The rhinophores are thick, with deep perfoliations; the tentacles also thick and of moderate

length. The anterior angles of the foot are produced into straight, stout processes.

The jaws are white and thin, with a single row of large irregular denticles. The radula consists of a single series of 16-18 white teeth, of horseshoe shape, with 7-8 lateral denticles extending up the sides of the central cusp. The bases of these denticles overlap, which gives the impression that there is a row of small secondary denticles below the main projections. This, however, is not, as a rule, really the case, though such secondary denticles do occur, but rarely. The penis, of the form usual in the genus, is armed with spines which have thick bases and are not very much bent.

These specimens can, I think, be referred to *F. Drummondii*, which (including the forms registered by Bergh as synonyms) is recorded from Scandinavia to the Mediterranean.

FAVORINUS CARNEUS? (Alder & Hancock). Pl. XIV, Figs. 13, 14.

Eolis carnea, Alder & Hancock: Brit. Nudibranch. Moll., pt. vii, p. 50, and Appendix, p. ix; Bergh, Verhandl. zool.-botan. Wien, 1875, vol. xxv, p. 641, *Favorinus*; 1883, vol. xxxii, p. 38; Trinchese, *Æolid. del Porto di Genova*, pt. ii, p. 67, *Favorinus*.

Two specimens. Mr. Crossland's notes are as follows:—

"Purple *Æolids*. 2 fathoms, Porto Sal Rei, Boa Vista Island.

"Cerata of a rather light purple or violet colour; body white. Tentacles long, rhinophores fairly so, and contractile. Foot drawn into short tentacles in front, and into a short tail behind. The cerata are easily lost, e.g. in picking the beasts from the weed on which they were found. Both were found on the same piece of weed, and there seem to have been no hydroids in the vicinity.

"The rhinophores are much longer and more slender than in any species hitherto seen. Length about the same as the oral tentacles, but very contractile, smooth, but with two swellings distally as in the sketch. Both specimens are alike in this. The rhinophores are brown basally, white after the first swelling. There are opaque white specks on the body, a few on the cerata, and a white ring immediately below the base of the latter."

The largest of the preserved specimens is 8 mm. long and 3 broad. Both have lost all their cerata, but, from the marks remaining on the body, it would appear that they were set in four distinct horseshoes, on slight prominences, with a fifth less distinct group, or pair of groups, near the tail. The rhinophores are much contracted, but the peculiar conformation described (Fig. 13) can still be traced. The anterior margin of the foot is drawn out into two short tentaculiform processes.

The jaws bear a row of long filament-like denticles, and, at its base, two or three rows of much smaller denticles. The uniseriate radula consists of 18 quite smooth teeth, as in Trinchese's plates of *Favorinus versicolor* (*Æolid. Porto di Genova*, pt. ii, pl. xxxiii, fig. 1), but somewhat less bent, and with stronger bases (Fig. 14).

This is perhaps the *Eolis carnea* of Alder & Hancock, recorded from Salcombe Bay. It agrees fairly well with their description, in

